


(19)  Canadian Intellectual Property Office	Office de la Propriété Intellectuelle du Canada	(11) CA 2 291 553	(13) A1
An Agency of Industry Canada	Un organisme d'Industrie Canada	(43) 26.05.2000	

(12)

(21) 2 291 553

(51) Int. Cl.: **H04Q 007/36**

(22) 26.11.1999

(30) 51062/1998 KR 26.11.1998

(71)

SAMSUNG ELECTRONICS CO., LTD.,
416, Maetan-dong
Paldal-gu,
Kyungki-do, SUWON-CITY, XX (KR).

(72)

LEE, YUN-HEE (KR).

(74)

SMART & BIGGAR

(54) **SYSTEME DE COMMUNICATIONS MOBILE POUR SERVICE EN ZONE LOCALE DE RATTACHEMENT ET METHODE CONNEXE**

(54) **MOBILE COMMUNICATION SYSTEM FOR HOME-ZONE SERVICE AND METHOD THEREOF**

(57)

A mobile communication system for providing home zone service, and a method thereof. In the mobile communication system, a home zone signal generator generates a home zone signal, a mobile radio terminal receives the home zone signal and determines whether the mobile radio terminal is currently within or outside a home zone based on the strength of the home zone signal, and a base station communicates with the mobile radio terminal. A visitor location register temporarily stores first and second telephone numbers of a subscriber, for which different charge rates are applied. A mobile exchange receives call information, a mobile identification number, and home zone in/out information from the base station and selects one of the first and second telephone numbers of a subscriber corresponding to the mobile identification number referring to the visitor location register according to the home zone in/out information. A billing center receives the call information and the first and second telephone numbers from the mobile exchange and bills for a call at a corresponding telephone number.

OPIC
OFFICE DE LA PROPRIÉTÉ
INTELLECTUELLE DU CANADA

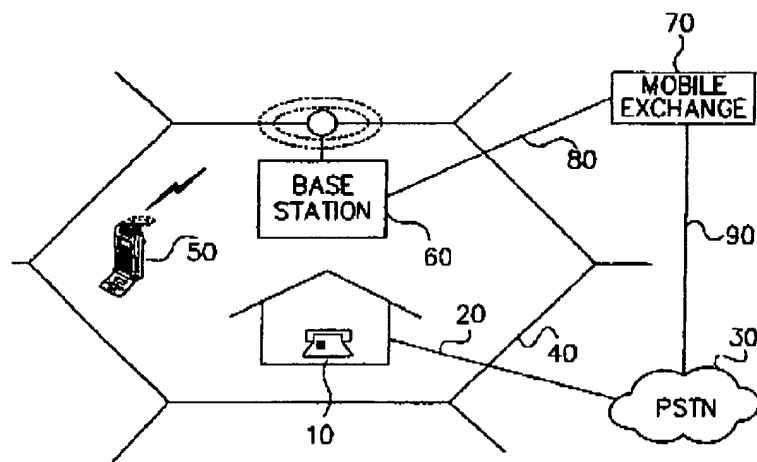


CIPPO
CANADIAN INTELLECTUAL
PROPERTY OFFICE

(12)(19)(CA) **Demande-Application**

(21)(A1) **2,291,553**
(22) 1999/11/26
(43) 2000/05/26

- (72) LEE, YUN-HEE, KR
(71) SAMSUNG ELECTRONICS CO., LTD., KR
(51) Int.Cl.⁷ H04Q 7/36
(30) 1998/11/26 (51062/1998) KR
(54) **SYSTÈME DE COMMUNICATIONS MOBILE POUR SERVICE
EN ZONE LOCALE DE RATTACHEMENT ET METHODE
CONNEXE**
(54) **MOBILE COMMUNICATION SYSTEM FOR HOME-ZONE
SERVICE AND METHOD THEREOF**



(57) A mobile communication system for providing home zone service, and a method thereof. In the mobile communication system, a home zone signal generator generates a home zone signal, a mobile radio terminal receives the home zone signal and determines whether the mobile radio terminal is currently within or outside a home zone based on the strength of the home zone signal, and a base station communicates with the mobile radio terminal. A visitor location register temporarily stores first and second telephone numbers of a subscriber, for which different charge rates are applied. A mobile exchange receives call information, a mobile identification number, and home zone in/out information from the base station and selects one of the first and second telephone numbers of a subscriber corresponding to the mobile identification number referring to the visitor location register according to the home zone in/out information. A billing center receives the call information and the first and second telephone numbers from the mobile exchange and bills for a call at a corresponding telephone number.



Industrie Canada Industry Canada

ABSTRACT OF THE DISCLOSURE

A mobile communication system for providing home zone service, and a method thereof. In the mobile communication system, a home zone signal generator generates a home zone signal, a mobile radio terminal receives the home zone signal and determines whether the mobile radio terminal is currently within or outside a home zone based on the strength of the home zone signal, and a base station communicates with the mobile radio terminal. A visitor location register temporarily stores first and second telephone numbers of a subscriber, for which different charge rates are applied. A mobile exchange receives call information, a mobile identification number, and home zone in/out information from the base station and selects one of the first and second telephone numbers of a subscriber corresponding to the mobile identification number referring to the visitor location register according to the home zone in/out information. A billing center receives the call information and the first and second telephone numbers from the mobile exchange and bills for a call at a corresponding telephone number.

P9030/ST2 (98-51062)

**MOBILE COMMUNICATION SYSTEM FOR HOME-ZONE SERVICE
AND METHOD THEREOF**

PRIORITY

5

This application claims priority to an application entitled "Mobile Communication System for Home-zone Service and Method Thereof" filed in the Korean Industrial Property Office on November 26, 1998 and assigned Serial No. 98-51062, the contents of which are hereby incorporated by reference.

10

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a mobile communication
15 system for home-zone service and a method thereof in a wireless communication network, and in particular, to a home-zone service providing system in which a second communication service provider can easily determine whether a wireless communication subscriber using a single terminal is within a home zone in order to charge the subscriber for a call inside the home zone at a first charge rate and
20 for a call outside the home zone at a second charge rate higher than the first charge rate, and a method thereof.

2. Description of the Related Art

As mobile radio communication services has widely been provided, the
25 number of subscribers has increased and now reaches the highest limit. Mobile communication service providers make efforts to attract even subscribers of competing wireline communication service providers. A wireline network was built long ago while an emerged wireless service provider serves on a different network. Wireline and wireless communications are different in many respects.

75998-41

The former is superior to the latter in voice quality and cost, though it is available in a confined area, for example, inside a house. Due to the impossibility of achieving an integrated wireless and wireline communication service in an actual situation, two communication networks are separately operated. In other words, a subscriber should purchase an additional telephone for radio communication in the suburbs or during moving from a house to another area, besides a telephone for a call inside the house. It is inefficient and inconvenient that a subscriber should have two telephones and their separate numbers.

FIG. 1 illustrates a conventional network configuration when a wireline service provider and a wireless service provider operate separate networks.

Within a cellular zone 40 being the coverage area of a base station 60, a subscriber has a first telephone 10 for use inside a house and a second telephone 50 for use outside the house. A wireline service is provided by cable from a PSTN (Public Switched Telephone Network) 30 through the first telephone 10 installed and used confinedly within the house. A wireless service is provided through the second telephone 50 in communication with the base station 60 within the cellular zone 60. A reference numeral 70 denotes a mobile exchange (or mobile switching center (MSC)) and reference numeral 80 denotes a line between the base station 40 and the mobile exchange 70. The line can be an E1 or T1 link. Reference numeral 90 denotes a line between the mobile exchange 70 and the PSTN 30, that is, a communication path between a wireless subscriber and a wireline subscriber.

FIG. 2 illustrates a fixed cellular network configuration.

A fixed cellular function refers to a limited function assigned to a cellular network for use in a confined area. This is used in an area like islands, wherein

P9030/ST2 (98-S1062)

cables cannot be installed and thus communication services are provided by radio. A fixed radio telephone 55 is fixed in a housing modified from a conventional terminal housing, for communication with the base station 60. A mobile radio telephone 45 communicates with the fixed radio telephone, for mobile
5 communication, and has a limited communication area in the vicinity of a house. A dotted portion indicated by reference numeral 65 is a communication area 65 in a fixed cellular environment, in which the mobile radio telephone 45 can communicate with the fixed radio telephone 55. The communication area 65 ranges from hundreds of meters to a few kilometers and corresponds to a home
10 zone.

As stated above, the fixed cellular communication scheme has the shortcoming of limited mobility despite its nature of radio communication. That is, the mobile radio telephone 45 should communicate with the base station 60
15 with the intervention of the fixed radio telephone 55 within a small communication area. Due to a call within the fixed home zone, however, a call charge is relatively low. In view of the foregoing features of the fixed cellular communication scheme, a wireless service provider can attract wireline subscribers by charging them for a radio call in a home zone at a charge rate as
20 low as a wireline charge rate.

FIG. 3 is a view illustrating a home zone defined over a network, referred to for describing a method of detecting the location of a subscriber over a wireless network.

25

Base stations 61, 63, 64, 67, and 69 are around a subscriber and used to detect a home zone. Reference numerals 71, 73, 74, 77, and 79 denote the respective coverage areas of the base stations 61, 63, 64, 67, and 69. A home zone 81 is marked with a circle. Within the home zone 80, a signal can be

75998-41

received from any of the base stations 61, 63, 64, 67, and 69. In other words, all the base stations 61, 63, 64, 67, and 69 can receive signals from the telephones 10, 50, and 55. The home zone 81 cannot be as small as that of which is covering a house in FIG. 1 or a communication area 65 which is ranging from about 20 to 30 meters from center of a house in FIG. 2.

In the prior art as described above, 3 to 8 base stations monitor the location of a terminal all the time and notify the detected terminal location to a mobile exchange, increasing load on a wireless network. In addition, a subscriber cannot receive both wireline and wireless communication services through a single terminal, let alone an efficient billing service for an integrated wireline and wireless communication service from a mobile communication service provider.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a mobile communication system for home-zone service and a method thereof in a wireless communication network, wherein a wireless subscriber using a single terminal is charged for a call inside a home zone at a first charge rate and for a call outside the home zone at a second charge rate.

The above object is achieved by providing a mobile communication system for providing home zone service and a method thereof. In the mobile communication system, a home zone signal generator generates a home zone signal, a mobile radio terminal receives the home zone signal and determines whether the mobile radio terminal is currently within or outside a home zone based on the strength of the home zone signal, and a base station communicates with the mobile radio terminal. A visitor location register temporarily stores first and second telephone numbers of a subscriber,

75998-41

for which different charge rates are applied. A mobile exchange receives call information, a mobile identification number, and home zone in/out information from the base station and selects one of the first and second telephone numbers of a subscriber corresponding to the mobile identification number referring to the visitor location register according to the home zone in/out information. A billing center receives the call information and the first and second telephone numbers from the mobile exchange and bills for a call at a corresponding telephone number.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a conventional network configuration when a wireline service provider and a wireless service provider operate their separate networks;

FIG. 2 illustrates a fixed cellular network configuration;

FIG. 3 illustrates a home zone defined over a network;

FIG. 4 illustrates a configuration of a wireless network;

FIG. 5 illustrates a communication method between a home zone signal generator and a terminal according to an embodiment of the present invention;

FIG. 6 is a view referred to for describing a case that a home zone signal generated from the home zone signal generator is in a cellular frequency band;

FIG. 7 is a view referred to for describing a case that the home zone

P9030/ST2 (98-51062)

rate depending on a call inside/outside a home zone according to the embodiment of the present invention;

FIG. 9 is a block diagram of a terminal for home-zone service in a wireless communication network; and

5 FIG. 10 is a view referred to for describing a method of setting adjacent base stations according to the embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

10 A preferred embodiment of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

15 FIG. 4 illustrates a configuration of a wireless network with a wireline network incorporated therein.

Referring to FIG. 4, a home zone signal generator 100 generates a signal indicating a home zone 81 and communicates at a low transmission power with a
20 terminal within the home zone 81. The home zone 81 can be confined inside the fence of a house according to the strength of a signal transmitted from the home zone signal generator 100. A terminal 150 is assigned to a national significant number (NSN) for billing the terminal 150 in the case of a call within the home zone 81, and to a mobile directory number (MDN) for billing the
25 terminal 150 in the case of a call outside the home zone 81. A visitor location register (VLR) 130 temporarily stores subscriber information including terminal information and additional service information. The NSN and MDN are stored in the VLR 130. Reference numeral 30 denotes a PSTN exchange, reference numeral 40 denotes the coverage area of the base station 60, and

75998-41

information and additional service information. The NSN and MDN are stored in the VLR 130. Reference numeral 30 denotes a PSTN exchange, reference numeral 40 denotes the coverage area of the base station 60, reference numeral 70 denotes the mobile exchange, and reference numeral 80 denotes a line between the base station 60 and the mobile exchange 70. The line can be an E1 or T1 link. Reference numeral 90 denotes the communication path between a wireless subscriber and a wireline subscriber. Reference numeral 140 denotes a billing center for billing a subscriber based on the call information and NSN/MDN of the subscriber received from the mobile exchange 70.

From the billing's perspective, the terminal 150 can be used for mobile use as well as for home use, as shown in FIG. 4. The terminal 150 senses a signal generated from the home zone signal generator 100, determines whether the terminal 150 is within the home zone 81 according to the strength of the sensed signal, and notifies the base station 60 of the determination. Then, the mobile exchange 70 informs the billing center 140 of the NSN or MDN of the terminal 150 referring to the VLR 130 so that the billing center 140 can apply a different charge rate for a call depending on whether the call is implemented within or outside the home zone 81. Here, assignment of the two telephone numbers are used just for billing and thus the switching to either number cannot be a cause of a call drop.

FIG. 5 illustrates a communication method between the home zone signal generator and the terminal according to the embodiment of the present invention.

In FIG. 5, the terminal 150 can receive a signal from the home zone signal generator 100 as far as the terminal 150 is located within the home zone. To do so, the terminal 150 uses the frequency in which it accesses the base station 60, that is, a reverse link frequency. This aims at discrimination between a signal directed from the base

75998-41

station 60 to the terminal and a signal directed from the home zone signal generator 100 to the terminal 150. The home zone signal generator 100 can transmit a plurality of about 10 modulation signals. By mutual agreement between the home zone signal generator 100 and the terminal 150, one of the modulation signals can be selected in order to prevent the terminal 150 from receiving even a signal generated from a home zone signal generator in a neighboring house. A single home zone signal generator can be shared among terminals of a plurality of family members.

FIGS. 6 and 7 are views referred to for describing the respective cases that a home signal generated from the home zone signal generator is in a cellular frequency band and in a PCS frequency band.

For communication with the terminal 150, home zone signal generator 100 uses the frequency which the terminal 150 uses to access the base station 60 through a reverse link. This aims to provide a discrimination between the signal detected from the base station 60 to the terminal 150, using one antenna, and the signal directed from the home zone signal generator 100 to the terminal 150.

A home zone signal in a cellular frequency band, especially a reverse link frequency or in a PCS frequency band does not interfere with a signal based a different communication scheme (e. g., signal of a cordless phone at 900MHz or signal of a paging frequency). The home zone signal generator 100 has nothing to do with a call and just generates a specific signal with a low transmission power. Thus, it can be fabricated with a low cost.

FIG. 8 is a flowchart depicting a method of applying a different charge rate depending on a call within/outside a home zone.

P9030/ST2 (98-51062)

based on the MIN received from the base station 60. The billing center 140 calculates a call charge of the terminal 150 at a first charge rate like a charge rate for a wireline call, in step S125. The calculated value is recorded as a call charge for the NSN.

5

On the other hand, if the terminal 150 has failed to receive the home zone signal in step S100, the terminal 150 notifies the base station 60 that it is beyond the home zone, in step S310. Then, the base station 60 transmits call information to the mobile exchange 70, notifying that the terminal 150 is outside
10 the home zone, in step S315 and the mobile exchange 70 transmits the call information to the billing center 140, notifying that the MDN of the terminal 150 is in use, in step 320. The MDN is detected from the VLR 130 based on the MIN received from the base station 60. The billing center 140 calculates a call charge of the terminal 150 at a second charge rate like a charge rate for a radio
15 call, in step S325. The calculated value is recorded as a call charge for the MDN.

When a call initiates and progresses within the home zone, steps S100 to S125 are sequentially performed. When a call initiates and progresses beyond
20 the home zone, steps S310 to S325 are sequentially performed. Yet, different billings are applied to a call if the terminal moves out of the home zone during the call in the former case or it enters the home zone during the call in the latter case. Therefore, the call information should be specified. That is, it should include the starting and termination times of a call within the home zone and a
25 call outside the home zone. A description of the times when the base station transmits the call information to the mobile exchange and the mobile exchange to the billing center will be omitted herein because it is not within the scope of the present invention.

P9030/ST2 (98-51062)

Step S100 can be applied to call termination as well as call origination. If a call is incoming, the terminal 150 determines whether a home zone signal has been received from the home zone signal generator 100 and notifies the base station 60 that the terminal 150 is within the home zone before call set-up if it is. 5 Then, the mobile exchange 70, notified of the terminal 150 being within the home zone by the base station 60, transmits the NSN of the terminal 150 to the billing center 140, so that the first charge rate is put on the call. On the contrary, if the home zone signal has not been received, the terminal 150 notifies the base station 60 of the fact and the mobile exchange 70, informed of the terminal 150 being 10 outside the home zone by the base station 60, transmits the MDN of the terminal 150 to the billing center 140, so that the second charge rate is put on the call.

FIG. 9 is a block diagram of a terminal for home-zone service over a wireless communication network according to the embodiment of the present 15 invention.

Referring to FIG. 9, a modulator 152 of the terminal 150 modulates a transmission signal and a signal indicative of reception or non-reception of a home zone signal from the home zone signal generator 100 by a home zone 20 signal detector 176. An existing antenna of the terminal 150 is used to receive the home zone signal, obviating the need for procuring an additional antenna. Therefore, there is no big cost increase caused by additional components in the terminal 150 according to the embodiment of the present invention.

25 A frequency up-converter 154 up-converts the frequency of an output signal of the modulator 152, and a transmission power amplifier 156 amplifies the output power of the frequency up-converted signal received from the frequency up-converter 154. A transmission filter 158 removes signals beyond a transmission frequency band from the amplified signal received from the

P9030/\$T2 (98-51062)

transmission amplifier 156 to prevent a signal in the transmission band from interfering with a different frequency band when the amplified signal is transmitted in the air. A transmission antenna 160 finally amplifies an output signal of the transmission filter 158 and transmits the final amplified signal in a
5 predetermined direction. The antenna 160 also receives a signal and amplifies the received signal. A reception filter 164 removes signals beyond a reception frequency band from the signal received through the antenna 160. A duplexer 168 is a signal separator, for separating a signal transmitted from the base station 60 and a signal generated from the home zone signal generator 100. A
10 frequency down-converter 172 down-converts the frequency of a signal received from the duplexer 168 so that the signal of the duplexer 168 can be used for communication. Another frequency down-converter 172 down-converts the frequency of the output signal of the duplexer 168 so that the output signal can be detected by the home zone signal detector 176. A demodulator 174
15 demodulates a message received from the base station 60. The home zone signal detector 176 detects the signal generated from the home zone signal generator 100. A signal mode changer 178 sets various signal modes with which the home zone signal detector 176 can detect a signal generated from the home zone signal generator 100. This can prevent the terminal 150 from being
20 tuned to a home zone signal generated from a different home zone when the same signal mode is used. A buzzer 180, when notified of detection of a home zone signal by the home zone signal detector 176, generates an audible sound or operates a light emitting diode (LED) to notify a subscriber that the terminal 150 is within the home zone.

25

Among the above described components, a dotted portion 190 including the duplexer 168, the frequency down-converter 162, the home zone signal detector 176, the signal mode changer 178, and the buzzer 180 represents a home zone signal receiver. The home zone signal receiver 190 is added to a

75998-41

which the home zone signal detector 176 can detect a signal generated from the home zone signal generator 100 depending on the setting of signal mode of home zone. This can prevent the terminal 150 from being tuned to a home zone signal
5 generated from a different home zone signal generator when the same signal mode is used. A buzzer 180, when notified of detection of a home zone signal by the home zone signal detector 176, generates an audible sound or operates a light emitting diode (LED) to notify a subscriber that the terminal
10 150 is within the home zone.

Among the above described components, a dotted portion 190 including the duplexer 168, the frequency down-converter 172, the home zone signal detector 176, the signal mode changer 178, and the buzzer 180 represents a home zone
15 signal receiver. The home zone signal receiver 190 is added to a conventional terminal according to the feature of the present invention to detect the home zone signal and notify the base station 60 whether the terminal 150 is within or outside the home zone. The operation of the home zone signal
20 receiver 190 will be described in more detail.

If the home zone signal detector 176 fails to detect a home zone signal generated from the home zone signal generator 100 before a call set-up upon call origination or call termination, or during a call, the terminal 150 notifies
25 the base station 60 the non-detection of the home zone signal. Then, the base station 60 in turn notifies the mobile exchange 70 of the non-detection of the home zone signal so that a higher charge rate for wireless service is applied to the call. A signal indicating whether the home zone signal has been
30 sensed or not, that is, whether the terminal 150 is within or outside the home zone is transmitted on an access channel used to set a protocol during an initial call set-up or a traffic channel used to set a protocol as well as to transmit a message during a call.

P9030/ST2 (98-51062)

the home zone, a subscriber which moves out of the home zone 81 by chance is notified to enter the home zone 81 again.

FIG. 10 is a view referred to for describing a method of setting adjacent
5 base stations according to the embodiment of the present invention.

In some cases, a subscriber may suffer a loss or get a benefit by moving the home zone signal generator 100. For example, he may move the home zone signal generator 100 from its registered location to another area and make up an
10 environment in which a call can be implemented as if the subscriber were in the home zone, for a less charge rate. To prevent this situation, it is necessary to check whether the terminal 150 considered to be within the home zone 81 is actually located in the home zone 81. For this purpose, at least one adjacent base stations (e.g., one to three base stations) to which the subscriber is registered
15 are detected and listed in a cell list as shown in FIG. 10. The information about the adjacent base stations is stored in a subscriber information database of the mobile exchange 70 as in table 1.

(Table 1)

name	address	first phone number	second phone number	first sector	second sector	third sector	remark
Liu	Sunnyvale	0342- 779- 8180	011- 779- xxxx	#32	#66	#96	
Mike	Palo Alto	0999- 999- 9999	011- yyy- yyyy	#10			
-	-	-	-	-	-	-	-

P9030/ST2 (98-51062)

According to table 1, each subscriber is assigned to an NSN (first phone number) for a call within the home zone 81 and an MDN (second phone number) for a call outside the home zone 81. Base station sector information associated with the subscriber is expressed using a PN (Pseudorandom Noise) code or other data. Each subscriber can be assigned to one to three sectors. Reference numerals 260, 270, and 280 denote base stations corresponding the sectors. If the base station information represents one of the base stations 260, 270, and 280 at an initial call set-up, it is considered that the terminal is within the home zone 81. The base stations are checked only once in the beginning because movement of the home zone signal generator 100, which should be in communication with the terminal 150, during a call disconnects a home zone signal and thus the home zone signal is checked during the call. therefore, no big load is imposed on the network.

As described above, the present invention has the advantages: (1) A reduced load is imposed on the network. That is, only in the case that the terminal has not receives a home zone signal from the home zone signal generator, the base station notifies the mobile exchange of the fact so that a different billing is applied; (2) The size of the home zone can be reduced. Installation of the home zone signal generator enables a predetermined area to be set for each subscriber and the home size to be reduced; (3) Accurate charges for a wireline call and a radio call can be calculated; and (4) Accuracy with which cost is laid on a subscriber is increased because the home zone signal generator is neat to the terminal and thus it can be more accurately determined whether the terminal is within or outside the home zone.

While the invention has been shown and described with reference to a certain preferred embodiment thereof, it will be understood by those skilled in the

P9030/ST2 (98-51062)

art that various changes in form and details may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

P9030/ST2 (98-51062)**WHAT IS CLAIMED IS:**

1. A mobile communication system for providing home zone service, comprising:
 - 5 a home zone signal generator for generating a home zone signal;
 - a mobile radio terminal for receiving the home zone signal and determining whether the mobile radio terminal is currently within or outside a home zone based on the strength of the home zone signal;
 - a base station communicating with the mobile radio terminal;
 - 10 a visitor location register for temporarily storing first and second telephone numbers of a subscriber, for which different charge rates are applied;
 - a mobile exchange for receiving call information, a mobile identification number, and home zone in/out information from the base station and selecting one of the first and second telephone numbers of a subscriber corresponding to
 - 15 the mobile identification number referring to the visitor location register according to the home zone in/out information; and
 - a billing center for receiving the call information and the first and second telephone numbers from the mobile exchange and billing for a call at a corresponding telephone number.
- 20 2. The mobile communication system of claim 1, wherein the home zone signal generator generates a signal in a CDMA (Code Division Multiple Access) frequency band.
- 25 3. The mobile communication system of claim 2, wherein the home zone signal generator generates a signal of a reverse link frequency.
4. The mobile communication system of claim 1, wherein the home zone signal generator generates a signal of a PCS (Personal Communication

P9030/ST2 (98-51062)

Service) frequency.

5. The mobile communication system of claim 1, wherein the mobile exchange has a cell list including at least one adjacent base station of an area where the home zone signal generator is first located, together with the subscriber information and determines whether the mobile radio terminal is within or outside the home zone by checking PN information of the base station only at an initial call set-up.

10 6. The mobile communication system of claim 1, wherein the home zone signal generator generates various modulation home zone signals so that one of the home zone signals is selected by mutual agreement between the home zone signal generator and the mobile radio terminal.

15 7. The mobile communication system of claim 1, wherein if the mobile radio terminal fails to receive the home zone signal during an initial call set-up or during a call, the mobile radio terminal notifies the base station of the failure of receiving the home zone signal on a reverse channel.

20 8. A mobile communication system for providing home zone service, comprising;

a home zone signal generator for generating a home zone signal;

a base station;

a mobile radio terminal for receiving the home zone signal from the home zone signal generator by radio and transmitting home zone in/out information to the base station, which includes a signal separator for separating the home zone signal and a signal generated in the base station from a signal received by radio, a home zone signal detector for receiving the home zone signal from the signal separator and sensing the home zone signal, a modulator for

P9030/ST2 (98-51062)

transmitting a modulation signal including a transmission message and information indicating detection or non-detection of the home zone signal, and a transmitter for processing the modulation signal and transmitting the processed signal by radio.

5

9. The mobile communication system of claim 8, wherein the home zone signal generator selectively transmits various modulated home zone signals and the mobile radio terminal further includes a signal mode changer for changing a signal mode with which the home zone signal detector can detect the
10 home zone signal of the home zone signal generator.

10. The mobile communication system of claim 8, wherein the mobile radio terminal further includes a buzzer for sounding an alarm indicating that the mobile radio terminal is within a home zone if the home zone signal
15 detector senses the home zone signal.

11. The mobile communication system of claim 10, wherein the buzzer generates an audible sound.

20 12. The mobile communication system of claim 10, wherein the buzzer has a light emitting diode and operates only when the home zone signal is sensed or not sensed.

13. A mobile communication system for providing home zone
25 service, comprising;

a home zone signal generator for generating a home zone signal;
a base station;

a mobile radio terminal for receiving the home zone signal from the home zone signal generator by radio and transmitting home zone in/out

75998-41

information to the base station, which includes a modulator for modulating a transmission message and transmitting the home zone signal together with the modulated message to the base station, a frequency up-converter for up-converting the frequency of the output signal of the modulator and generating a transmission signal, a transmission power amplifier for amplifying the transmission signal, a transmission filter for removing signals beyond a transmission frequency band to prevent an interference with a different frequency band when the amplified signal is transmitted to the air, an antenna for finally amplifying the transmission signal received from the transmission filter and transmitting the amplified signal to the air, or receiving a signal from the air and amplifying the received signal, a reception filter for removing signals beyond a reception frequency band from a signal received from the antenna, a duplexer for separating the signal received from the reception filter into a signal transmitted from the base station and a signal transmitted from the home zone signal generator, a frequency down-converter for down-converting the frequency of the signal generated in the home zone signal generator, received from the duplexer, a home zone signal converter for detecting the home zone signal from the frequency down-converted signal, a signal mode changer for changing a signal mode so that the home zone signal detector matches a detectable frequency to the frequency of the home zone signal generated from the home zone signal generator, and a buzzer for sounding an alarm to indicate that the home zone signal is sensed if the home zone signal is detected by the home zone signal detector.

14. A home zone service method in a mobile communication system, comprising the steps of:

(1) determining whether a mobile radio terminal has received a home zone signal from a home zone signal generator and transmitting home zone in/out information to a base station by the mobile radio station;

75998-41

(2) transmitting call information, a mobile identification number, and the home zone in/out information to a mobile exchange by the base station;

(3) selecting one of first and second telephone numbers of a subscriber corresponding to the mobile identification number referring to a visitor location register according to the home zone in/out information by the mobile exchange; and

(4) receiving the call information and the selected telephone number from the mobile exchange and billing for a call at the selected telephone number by a billing center.

15. The home zone service method of claim 14, wherein different charge rates are applied for calls at the first and second telephone numbers.

15 16. The home zone service method of claim 14, wherein the first telephone number is a wireline telephone number and the second telephone number is a radio telephone number.

17. The home zone service method of claim 14, wherein the steps (1), (2), and (3) are performed before a call set-up upon call origination and termination.

18. A home zone service method in a mobile communication system, comprising the steps of:

(a) determining whether a mobile radio terminal has received a home zone signal from an external home zone signal generator and transmitting home zone in/out information to a base station by the mobile radio station, transmitting a call starting time, a mobile identification number, and the home zone in/out information to a mobile exchange by the base station, and selecting one of first and second telephone numbers of a subscriber corresponding to the mobile

75998-41

identification number referring to a visitor location register according to the home zone in/out information by the mobile exchange, before a call set-up upon call origination or call termination; and

5 (b) transmitting a call end time, the mobile identification number, and the home zone in/out information to the mobile exchange by the base station when the base station has not received information about a home zone in/out change from the mobile radio terminal, after the call set-up;

10 (c) performing the following steps C-1 and C-2 every time the base station receives home zone in/out change information from the mobile radio terminal and transmitting a call end time, the mobile identification number, and the home zone in/out information when the call ends by the base
15 station, after the call set-up; and

(C-1) transmitting a call changed time, the mobile identification number, and the home zone in/out information to the mobile exchange by the base station,

(C-2) selecting the other telephone number of
20 the subscriber corresponding to the mobile identification number referring to the visitor location register according to the home zone in/out information by the mobile exchange; and

(d) receiving the call information and the first or
25 second telephone number of the subscriber from the mobile exchange and billing the call at the corresponding telephone number.

19. The home zone service method of claim 18, wherein
30 the call information includes a call starting or changed time and a call end time, and the call changed time is both the end time of a call before a home zone in/out change and a starting time of a call after the home zone in/out change.

CA 02291553 1999-11-26

1/8

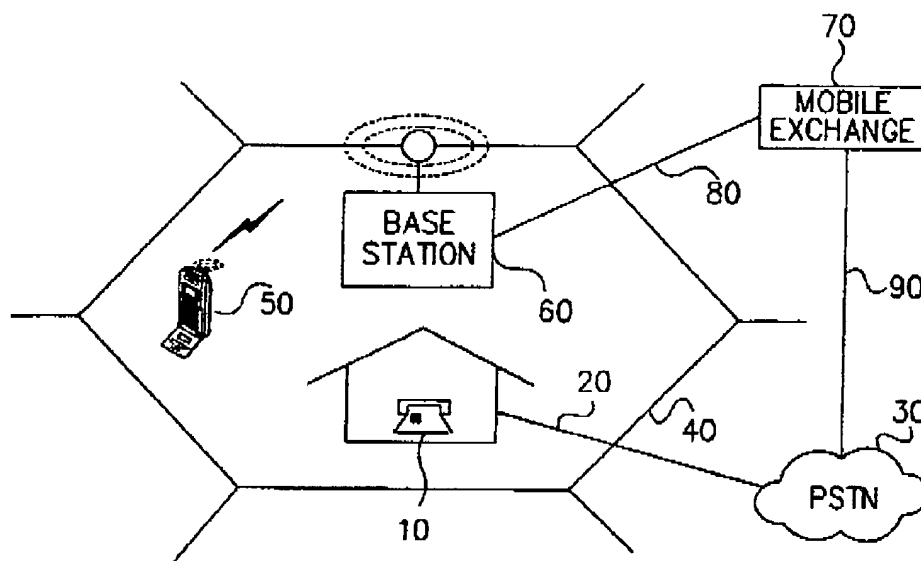


FIG. 1

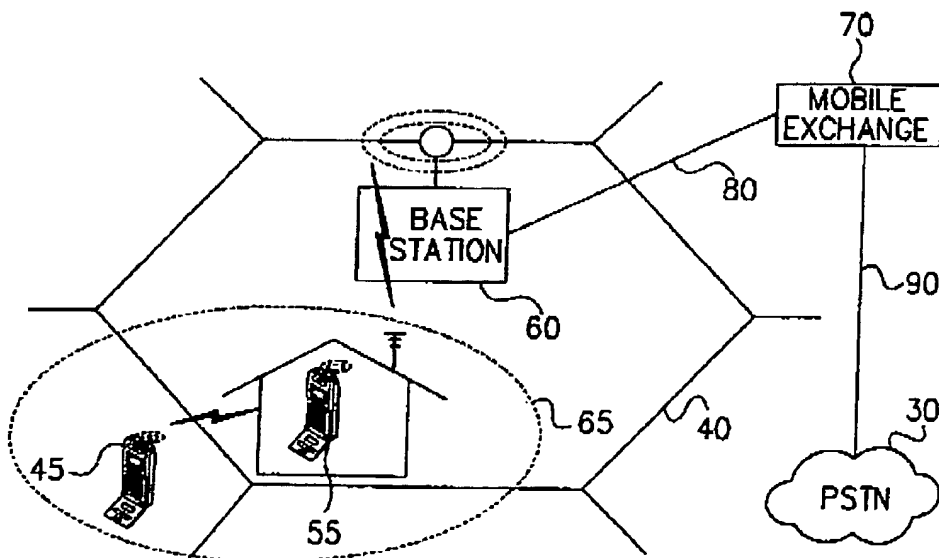


FIG. 2

CA 02291553 1999-11-26

2/8

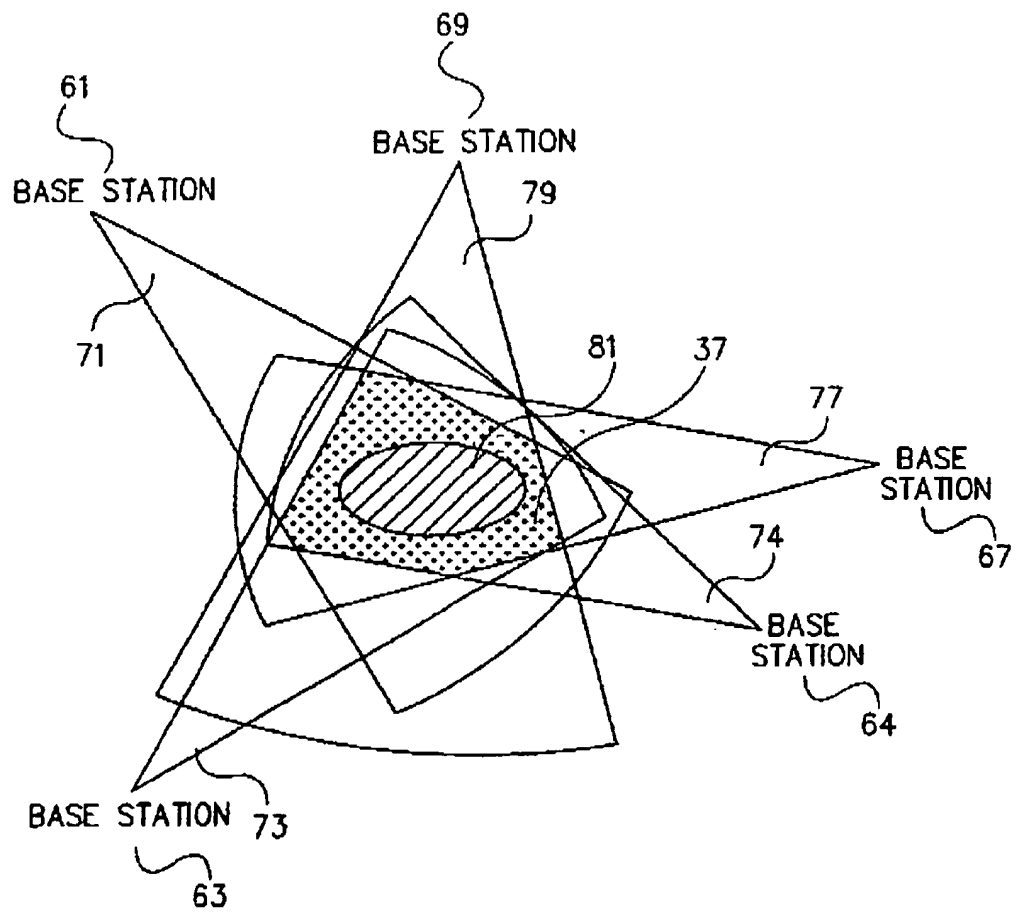


FIG. 3

CA 02291553 1999-11-26

3/8

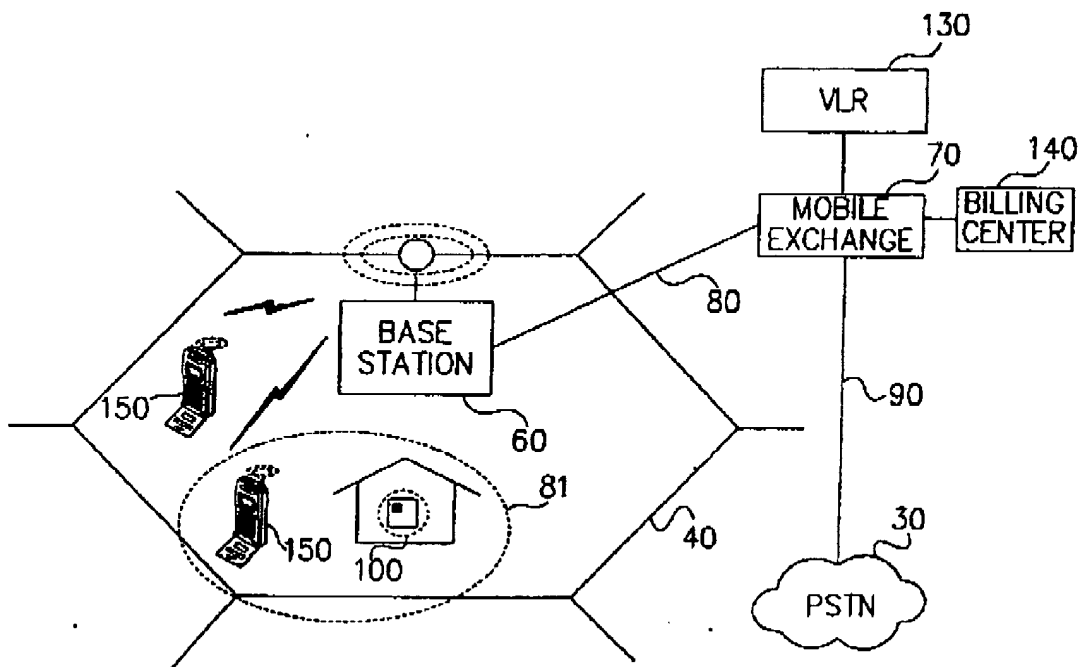


FIG. 4

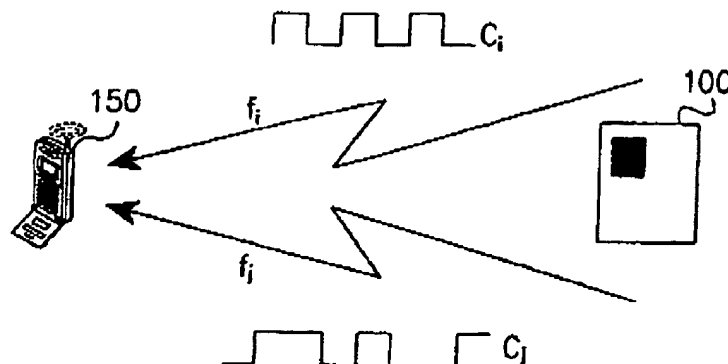
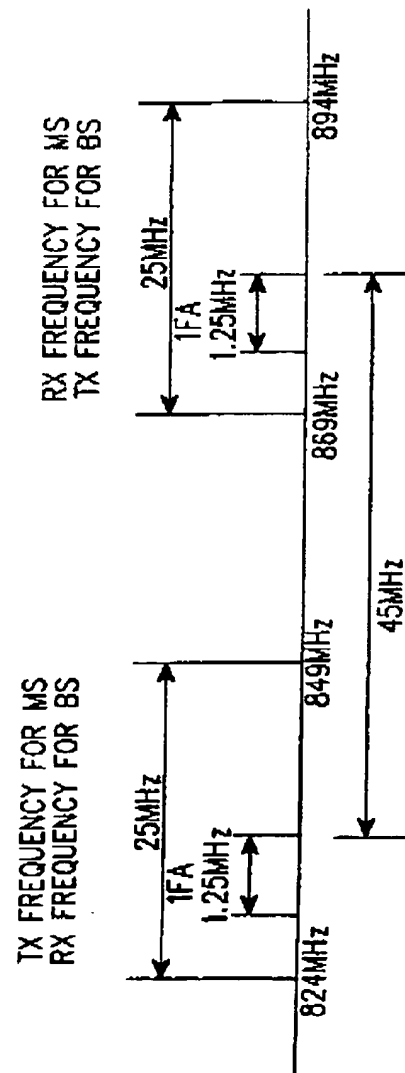


FIG. 5

CA 02291553 1999-11-26

4/8

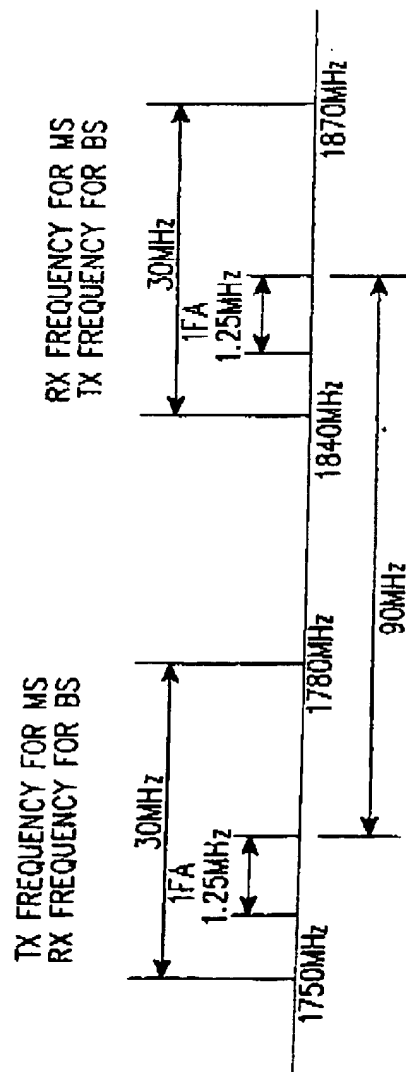
FIG. 6



CA 02291553 1999-11-26

5/8

FIG. 7



CA 02291553 1999-11-26

6/8

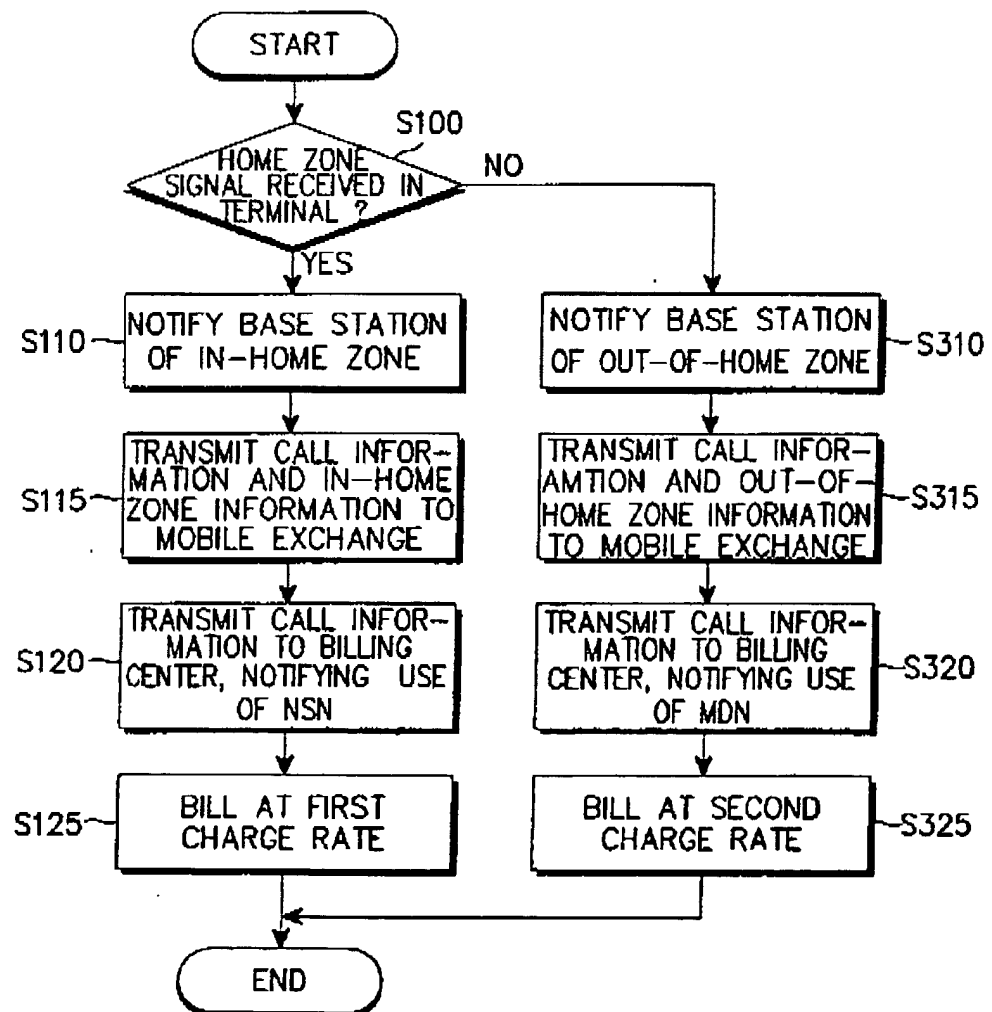
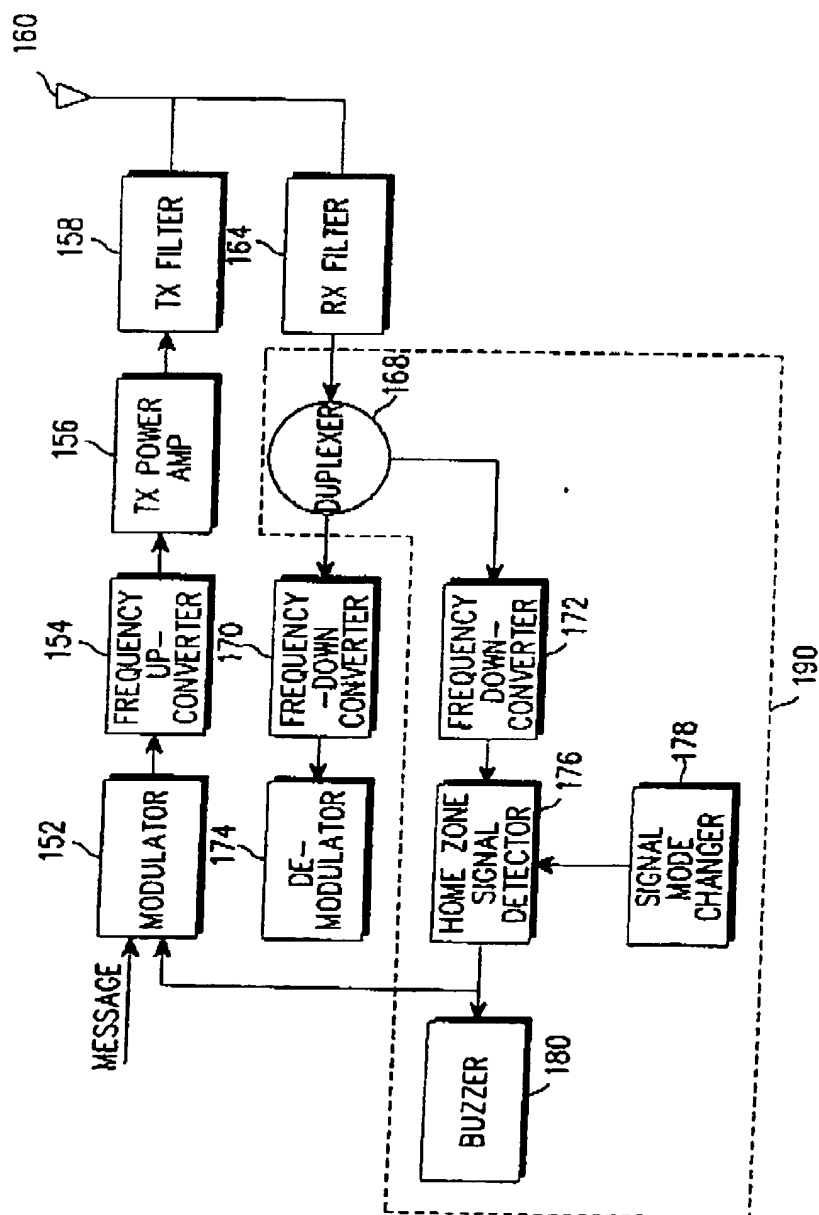


FIG. 8

CA 02291553 1999-11-26

7/8

FIG. 9



CA 02291553 1999-11-26

8/8

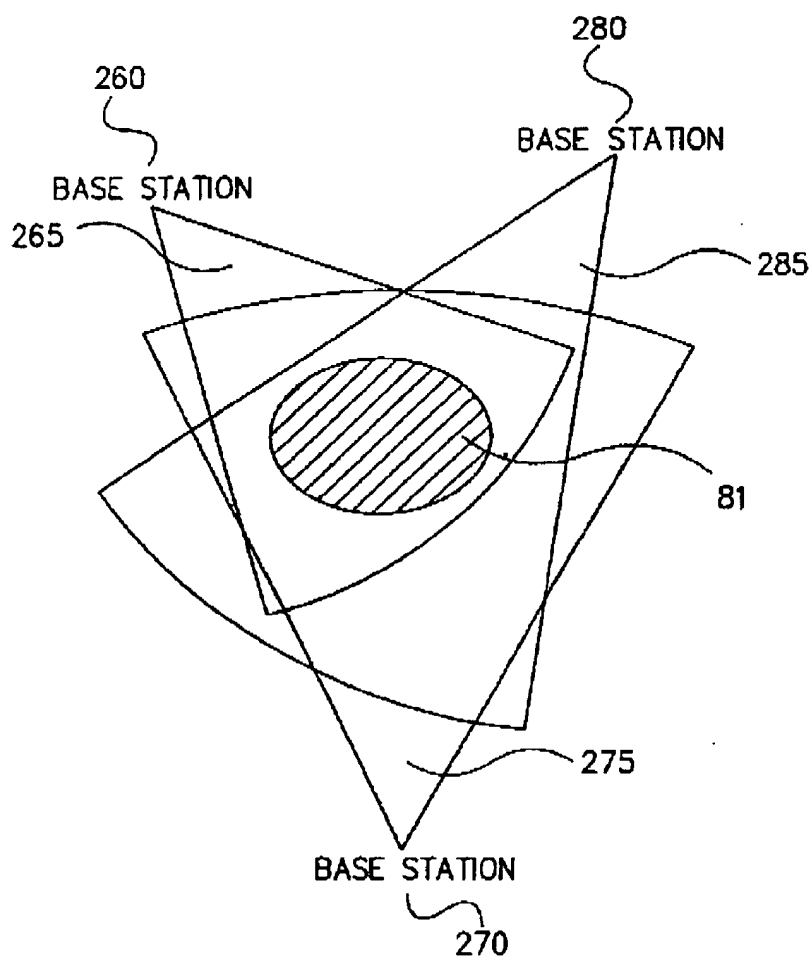


FIG. 10